Globalization of engineering education research:
Citation Analysis of ASEE and SEFI Conference Papers

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Keywords: globalization; engineering education research; citation; bibliometric analysis

INTRODUCTION

There has been an increasing focus on the globalization of Engineering Education Research (EER) in recent years and recognising this, in 2007 the editors of the Journal of Engineering Education (JEE) and the European Journal of Engineering Education (EJEE), Jack Lohmann and Jean Michel, respectively, launched a worldwide initiative called Advancing the Global Capacity for Engineering Education Research. In a resulting paper published jointly by EJEE and JEE in 2010 (Jesiek, Borrego & Beddoes, 2010), it was suggested that “the field of engineering education research is going global” and Jesiek and colleagues went on to propose a model whereby engineering education scholarship could advance locally and globally via cycles of translation and enrolment which would connect local practice and contexts with a global core of knowledge. These authors encouraged EER practitioners to “look for opportunities to translate research questions, theories, methods, and findings so they are readable and relevant across national and institutional boundaries” and urged scholars to “think globally about the development of engineering education as a research field, while acting locally to enrol new actors and perform context-sensitive translations”.

However, an analysis of empirical research in leading EER journals up to 2008 (Jesiek et al., 2011) showed that the majority of published authors in the analysed articles came from the US (36%) with the EU and Australia providing 29% and 23% respectively and the level of international co-authorship was relatively low at 8%. Although we might assume that in the intervening years this trend might have

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diminished due to increased globalization, we note that a recently published list of the most collaborative co-authors in EER (Strobel et al 2012) contains only US scholars. Furthermore, a recent analysis of 24,172 papers in engineering education research journals and conference proceedings over the period 2000-2011 (Xian and Madhavan, 2014) has found that in-state collaboration within the US is significantly more frequent than between-state collaboration which again suggests that geographical location can strongly influence how scholars engage in collaboration.

The three empirical studies above focused on the most published authors and those with whom they co-authored but do not provide information on what sources these scholars consulted when carrying out their work. Even if published research in the principal journals and conferences in the field does come predominantly from US authors, these researchers may nevertheless be becoming more global in their outlook and be considering global sources in their research.
One credible way of detecting such a trend is to analyse the sources cited by authors and that is the approach adopted here. If such a global outlook had already evolved we would assume that EER scholars in different parts of the globe would cite a global range of authors in their publications. However, when the authors tested this hypothesis for two leading archival journals, JEE published by ASEE (American Society of Engineering Education) and EJEE published by SEFI (the European Society of Engineering Education) they found that although the scholars whose work was published in the European journal cited a geographically wide range of authors, those in the US-based JEE tended to predominantly cite US authors (Williams et al, 2014; Wankat et al., 2014).

1 METHODOLOGY AND PROCEDURE

To what extent has EER become global? Given that the number of scholars whose research appears in the proceedings of the annual conferences of SEFI and the ASEE considerably exceeds those published annually in their two journals we had previously studied (Williams et al, 2014), analysis of the conference proceedings should provide a broader and more representative sample of the EER carried out on the two sides of the Atlantic. Hence we carried out a bibliometric analysis of the works cited in recent SEFI and ASEE conference proceedings so as to compile empirical data on the extent to which the scholars presenting at these conferences cite a global range of well-known authors.

2 RESULTS

The cited authors were separated into three groups based on geographic location: US, Europe, and Other (all other countries). Citations of specific well-known authors were counted in all the papers in the ASEE conference proceedings for 2010 and 2014 (1400 and 1700 papers respectively) and SEFI proceedings from 2010 to 2014 inclusive (833 papers in all). Self-citations were not included. Although organisations such as the ASEE, NSF, UNESCO and ABET were frequently referred to in the texts of the papers studied and were also, albeit less frequently, referred to in the references we have opted to confine our quantitative analysis to cited authors rather than organizations.

Table 1 Most cited authors in SEFI conferences from 2010 to 2014 (833 papers)

Author	Cites	Location
Kolmos, A	66	Europe
Felder, RM	56	US
Biggs, J.	47	Europe
De Graaff, E	43	Europe
Borrego, M.	42	US
Crawley, E. F.	38	US
Marton F	30	Europe
Johnson, DW & RT	25	US
Adams, Robin S.	23	US
Kolb, DA	22	US
Sheppard, S	22	US
Trevelyan, J	21	Other
Jesiek, B	20	US
Jonassen D H	18	US
Prince MJ	17	US
Smith, Karl	16	US
Atman, C	15	US
Bandura A	15	US
Brent, R.	15	US
Bloom B. S.	13	US
Bucciarelli, L	13	US
Lucena, J.	13	US
Turns, J	12	US
Duderstadt	12	US
Graham, R.H	12	Europe
Willey, K	11	Europe
Ohland, M	10	US
Bernhard J	10	Europe
Baillie, C	10	Other
Case, Jennifer	10	Other
Gardner, Anne	10	Other
Boyer, E. L.	9	US
Olds, B	9	US
Shuman, L. J.	9	US

Author	Cites	Location
Silverman, LK	9	US
Terenzini TP	9	US
Wankat P	9	US
Besterfield-Sacre	9	US
Douglas, E	8	US
Cardella, ME	8	US
Krathwohl	8	US
Downey, G L	8	US
Vygotsky, LS	8	Europe
Fraser, Duncan	8	Other
Hadgraft R	8	Other
Patil,Arun	8	Other
Dym, CL	7	US
Feisel LD	7	US
Kuh, GD	7	US
NAE	7	US
Streveler, R.	7	US
Gibbons M	7	Europe
Agogino, A. M.	6	US
Bransford, J. R.	6	US
Brophy, S. P.	6	US
Diefes-Dux	6	US
Jenkins A	6	US
Litzinger T	6	US
Lohmann, J	6	US
Pascarella, E. T.	6	US
Strobel, J. US	6	US
Woods, DR	6	Other
McGourty, J.	6	US
Anderson, L. W.	5	US
Cox, M. F. US	5	US
Froyd J	5	US
Lindsay, E	5	Other
Nair , C S	5	Other
Oakes, W. C.	5	US
Pawley	5	US
Perry, W. G.	5	US
Radcliffe D. F.	5	US
Schon, D. A.	5	US
Finelli, C. J.	5	US

Table 2: Geographical breakdown of the most cited authors SEFI 2010 - 2014

US	Cites
Felder, RM	56
Borrego, M.	42
Crawley, E. F.	38
Johnson, D & R	25
Adams, R. S.	23
Kolb, D A	22
Sheppard, S	22
Jesiek, B	20
Jonassen D H	18
Prince MJ	17
Smith, Karl	16
Atman, C	15
Bandura A	15
Brent, R.	15
Bloom B. S.	13
Bucciarelli, L	13
Lucena, J.	13
Turns, J	12
Duderstadt	12
Ohland, M	10
Boyer, E. L.	9
Olds, B	9
Shuman, L. J.	9
Silverman, LK	9
Terenzini TP	9
Wankat	9
Besterfield-Sacre	9
Douglas, E	8
Cardella, ME	8
Krathwohl	8
Downey, G L	8
Dym, CL	7
Feisel LD	7
Kuh, GD	7
Streveler, R.	7
Lohmann, J	6
Agogino, A. M.	6
Bransford, J. R.	6
Brophy, S. P.	6
Diefes-Dux	6

European	Cites
Kolmos, A	66
Biggs, J.	47
De Graaff, E	43
Marton F	30
Graham, R.H	12
Bernhard J	10
Vygotsky, LS	8
Gibbons M	7
Jenkins A	6
Alpay, E	4
Azapagic, A.	4
Gill J	4
Lehmann, M.	4

Other	Cites	Location
Trevelyan, J	21	Australia
Willey, K	11	Australia
Baillie, C	10	Australia
Case, J	10	S. Africa
Gardner, A	10	Australia
Fraser, D	8	S. Africa
Hadgraft R	8	Australia
Patil, A	8	Australia
Woods, DR	6	Canada
Lindsay, E	5	Australia
Nair , C S	5	Australia
Brodie L	4	Australia
Rugarcia, A	4	Mexico
Scott, G	4	Australia
Shallcross, D	4	Australia

Table 3 Most cited authors for the 2010 ASEE conference (1,400 papers)

	2010	
Authors	**Cites**	**Location**
Felder, RM	177	US
Sheppard, S	76	US
Bransford, J. R.	72	US
Atman, C	63	US
Bloom B. S.	52	US
Ohland, M	52	US
Johnson, DW & RT	48	US
Smith, Karl	48	US
Shuman, L. J.	45	US
Brent, R.	44	US
Terenzini TP	43	US
Prince MJ	42	US
Miller, R. L.	40	US
Seymour, E	40	US
Bandura A	39	US
Besterfield-Sacre M	39	US
Dym, CL	38	US
Wankat, P	34	US
Adams, Robin S.	32	US
Pascarella, E. T.	30	US
Olds, B	29	US
Brophy, S. P.	28	US
Oakes, W. C.	27	US
Astin, AW	27	US
McGourty, J.	27	US
Silverman, LK	26	US
Woods, DR Canada	26	Other (Canada)
Hewitt, N. M.	25	US
Froyd J	24	US
Agogino, A. M.	23	US
Litzinger T	23	US
Rogers, G	23	US
Eccles, J. S.	21	US
Latucca, L. R.	21	US
Oreovicz, F	21	US
Streveler, R.	21	US
Turns, J	21	US
Lesh, R. A.	20	US
Cross, N	18	Europe
Duderstadt	18	US
Vygotsky, LS	17	Europe

Table 4 Most cited authors for the 2014 ASEE conference (1,700 papers)

	2014	
Authors	**Cites**	**Location**
Felder, RM	242	US
Sheppard, S	115	US
Ohland, M	94	US
Adams, Robin S.	87	US
Smith, Karl	87	US
Prince MJ	85	US
Borrego, M.	84	US
Bransford, J. R.	74	US
Dym, CL	73	US
Brent, R.	73	US
Bandura A	66	US
Miller, R. L.	65	US
Terenzini TP	55	US
Atman, C	54	US
Turns, J	54	US
Cardella, ME	49	US
Oakes, W. C.	48	US
Johnson, DW & RT	48	US
Olds, B	48	US
Kuh, GD	47	US
Shuman, L. J.	47	US
Agogino, A. M.	46	US
Jonassen D H	46	US
Froyd J	44	US
Bloom B. S.	43	US
Streveler, R.	43	US
Besterfield-Sacre M	43	US
Brown, A. L.	43	US
Cocking, R. R.	42	US
Astin, AW	39	US
Seymour, E	38	US
Eccles, J. S.	37	US
Strobel, J.	34	US
Pascarella, E. T.	32	US
Kolb, DA	31	US
Litzinger T	31	US
Finelli, C. J.	31	US
Brophy, S. P.	30	US
Silverman, LK	28	US
Woods, DR	28	Other (Canada)
Krathwohl	28	US
Downey, G L	27	US

Stice, J. E.	24	US
Harding, T. S.	24	US
Cross, N	23	Europe
Hewitt, N. M.	23	US
Newstetter, WC	23	US
McKenna, A	23	US
Vygotsky, LS	22	Europe
Wankat P	22	US

3 DISCUSSION

Tables 3 and 4 show that citations in ASEE conferences were overwhelmingly dominated by sources with US affiliations, which does not support the globalization hypothesis. On the other hand, the SEFI data (Tables 1 and 2) show that while US sources are the most cited, European and Other authors are also well represented.

It is interesting to note that Richard Felder is the most cited scholar in both ASEE conferences as was the case in the authors' analysis of highly-cited authors in EJEE and JEE (Williams et al, 2014) as indeed in Wankat's 2004 list of most-cited authors (Wankat, 2004). In the SEFI conferences Felder is the second most referenced scholar while Anette Kolmos was the most cited. We could conclude that Felder's work on active and collaborative learning is highly influential on both sides of the Atlantic while Kolmos' work on PBL (project and problem based learning) is a major reference for European scholars.

4 CONCLUSION

The short answer to the question posed in section 1 is that in citation terms, European EER is global but US EER is not. Establishing the causes for this situation represents an important challenge for future research - one which needs to be addressed if EER is to evolve as a truly global field of inquiry.

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